Watershed Protection: A Project Focus
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Chapter 5: Defining the Problem

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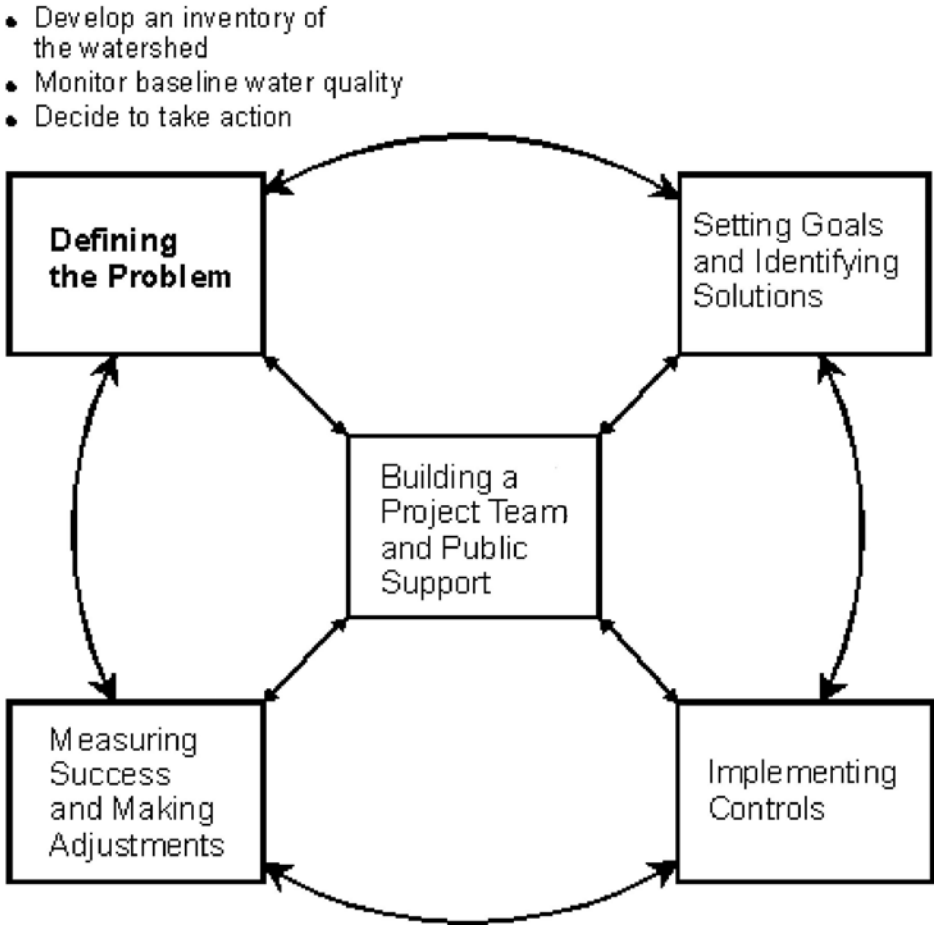

This chapter discusses the process of gathering available information about the watershed and its water quality problems. Preparing an inventory of the watershed and starting a baseline monitoring program are usually critical to the ultimate success of a project.

Develop an Inventory of the Watershed

An inventory of the watershed helps ensure that project team members have a consistent knowledge base and helps focus their attention on the most significant problems or ecosystem threats.

The inventory and assessment of baseline conditions and water quality problems is sometimes documented in a watershed assessment report; an example format is shown in

Figure 7. This report provides direct input to the goal-setting process and to preparation of a watershed action plan, discussed in Chapter 6.

Prior to beginning a watershed assessment report, writers should ensure that the product will be compatible with statewide databases and basin plans in both format and approach. For example, data analysis methods for assessing designated use support should follow methods used by the state for their biennial reports under CWA Section 305(b). Where possible, databases and hard copy reports should be suitable for inclusion in statewide or basinwide assessment databases and reports. State 305(b) Coordinators are often the key contacts for ensuring this type of compatibility.

Background Information on the Watershed

Most watershed projects are selected based on some type of geographic targeting, so considerable information about the resource and its problems usually exists. For example, water quality data on at least a portion of each watershed are needed to develop water body rankings. At the point when watersheds are targeted, information such as the following is often available from state Section 305(b) reports, State Water body System databases, and other public sources:

Sizes, locations and designated uses of all water bodies

Water bodies having impaired use support

Causes of impairment (e.g., pollutants, habitat limitations)

Physical/chemical and biological water quality

Locations and loadings from point sources

Categories of nonpoint sources and estimates of loadings

Groundwater quality

Sources impacting groundwater

Fish and wildlife surveys

Topographic and hydrologic maps

Crude land use maps.

Such readily available data can be supplemented by other data types needed for the critical steps to follow--goal-setting and selection of point and nonpoint source management measures:

Detailed soil survey

Locations of highly erodible soils

Locations of critical riparian areas

Locations of critical instream habitat areas

Locations of sensitive ground water areas (e.g., recharge zones)

Demographics and growth projections

Economic conditions--e.g., income, employment

Detailed existing and projected land use

Locations and sizes of animal operations

Locations of nonpoint source controls.

Figure 7. Topics for a watershed assessment

I. Watershed Description

A. Name, size, administrative boundaries
B. Geographic locators--Federal or State identification numbers
C. Maps

II. Physical Characteristics

A. Geology, topography,
B. Soils
C. Land use/land cover
D. Ecoregion(s)
E. Hydrology

III. Critical Areas

A. Surface water
- waters with endangered or threatened species
- critical fishery areas, outstanding resource waters
- critical riparian and instream habitat
- water supplies

B. Ground water
- water supplies
- recharge areas
- springs, other vulnerable areas

IV. Water Quality

A. Designated uses and use support

B. Watershed's water quality problems
- physical/chemical
- biological
- habitat (including flow needs)

- other problems or sources of stress
IV. Point and Nonpoint Sources
A. Point source locations, loadings (if applicable)
B. Nonpoint source locations, loadings (if applicable)
C. Control measures in place--types, locations, effectiveness
V. Information Needs
A. Baseline monitoring program
B. Other data gaps
C. Information management systems

Sources for these data include state surface and ground water databases and reports, local agency reports, state or local geographic information system (GIS) databases, and aerial photography. NRCS Field Office Technical Guides (county level) are excellent sources of information on soils, water, plants, animals, nonpoint source BMPs and other topics. Contact the NRCS Midwest National Technical Center at (402)437-5315 for more information.

Finally, and of great importance, decision makers and project staff should conduct a first-hand survey of the watershed--walking along streams to observe overall ecosystem health and driving around the watershed or flying over it to observe land uses and sources of pollution. During these forays, technical experts can describe to decision makers the impacts of traditional pollutants (e.g., sediments and nutrients) and of nontraditional stressors (habitat loss, bank erosion).

Problem Statement

Whether or not a watershed assessment report is written, a detailed statement of the watershed's water quality problems may be essential to the ultimate success of the project. Types of problems frequently identified in watershed projects include:

Excessive sediment or nutrients reaching sensitive water bodies

Reduced fish harvest

Reduced anadromous fish spawning range

High stream temperatures

Riparian habitat damage by timber harvests

Nitrate contamination of ground water.

The problem statement may include more problems than were identified in the statewide priority-setting process. For example, a watershed may be selected on the basis of a high priority for TMDL development because of nutrient enrichment of an estuary; upon more detailed study, ground water contamination and loss of riparian habitat may also become key issues.

A problem statement, agreed to by the various stakeholders, begins to merge their interests and helps to focus upcoming monitoring activities. The statement includes information about the type and location of threatened or existing water use impairments, pollutants, and sources, as well as economic impacts associated with the water quality problem. Problem statements may be developed for individual sub-watersheds if plans will be written at that scale.

Highlight 5

Sequim Bay's Solution to Problem Identification

"Rather than spend our time evaluating traditional sources of nonpoint pollution, our watershed management committee focused on goals and objectives," reports Katherine Baril, project manager of the Sequim Bay Water Quality Project. "This allowed us to avoid the traditional--and perhaps more adversarial--methods of analysis originally used to evaluate industrial sources of pollution.

"In this way, we could begin to look at common contributors and common solutions. For example, instead of looking at agriculture or forestry as a problem to be fixed, we recognized that all sectors of the community were potential contributors of bacteria, sediment, and other forms of nonpoint pollution. At the same time, we realized that there were certain things we all wanted--viable industries, open space, and good stewardship in our watershed."

At this stage, it may not be necessary to quantify pollutant loadings from specific sources. To keep momentum, the stakeholders might do better to agree that multiple sources

contribute to the problems rather than focusing blame on one or two sources (see Highlight 5, Sequim Bay, Washington).

Table 5-1 summarizes pollutants or stressors that may cause watershed impairments and their most likely sources (adapted from EPA, 1987). Nontraditional stressors such as habitat loss are not as well documented as chemical pollutants, but are the subject of recent investigations. See, for example, *Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy* (National Research Council, 1992) and *Entering the Watershed* (Doppelt et al., 1993).

Monitor Baseline Water Quality

Lack of baseline water quality data has been a problem in past watershed projects. If adequate data are not collected prior to implementation of a watershed action plan, the project team may be unable to document the improvements that result from controls or restoration. Therefore, baseline monitoring should begin during the early planning and goal-setting process.

Table 2. Sources and Causes of Water Quality Impairment

Pollutant or stressor	Possible sources
Sediment	Cropland Forestry activities Pasture Streambanks Construction activities Roads Mining operations Gullies Livestock operations Other land-disturbing activities
Nutrients	Erosion and runoff from fertilized areas Urban runoff Wastewater treatment plants Industrial discharges Septic systems Animal production operations Cropland or pastures where manure is spread
Bacteria	Animal operations Cropland or pastures where manure is spread Wastewater treatment plants Septic systems Urban runoff Wildlife
Pesticides	All land where pesticides are used (forest, pastures, urban/suburban areas, golf courses, waste disposal sites) Sites of historical usage (chlorinated pesticides) Urban runoff Irrigation return flows
Altered flow regime or habitat modification	Impoundments Urban runoff Artificial drainage Bank destruction Riparian corridor destruction

If possible, a water quality monitoring program should extend through the life of the project in a continuum that includes:

Baseline monitoring to show water quality conditions prior to implementation of controls

Interim and post-implementation monitoring to show effectiveness of individual controls and the overall watershed project.

Baseline monitoring programs are watershed-specific, and involve principles of monitoring design that are discussed in various texts and EPA publications such as:

Watershed Monitoring and Reporting for Section 319 National Monitoring Projects (EPA, 1991b)

Rapid Bioassessment Protocols for Use in Streams and Rivers (Plafkin et al., 1989)

Draft Surface Water Monitoring Program Guidance (EPA, 1990a)

Monitoring Guidance for the National Estuary Program (EPA, 1992b)

Draft Nonpoint Source Monitoring and Evaluation Guide (EPA, 1988)

Methods for Evaluating Stream Riparian and Biotic Conditions (Platts et al., 1983)

Appropriate Designs for Documenting Water Quality Improvements from Agricultural NPS Control Programs (Spooner et al., 1985).

In general, baseline monitoring (a) measures concentrations and loadings of the pollutants in main stems and tributaries prior to the implementation of controls; (b) includes biological monitoring (typically, for fish and macroinvertebrates) and habitat assessment; and (c) measures edge-of-field loadings in some areas where controls will be installed.

Some baseline monitoring sites should be selected to detect watershed-wide changes in water quality over time. Planners may make judgments about sites that will be useful in before-and-after analyses to show the effectiveness of controls--e.g., sites downstream of areas where stringent point source permit limits will be imposed or where BMPs will be installed. Before-and-after monitoring is often effective where point sources are involved, but can be difficult to implement for nonpoint sources. As discussed in Highlight 6, unless planners know exact locations where nonpoint source controls will be installed, a paired sampling approach may be more effective. Paired sampling sites are selected on separate small watersheds or catchments. Ideally, the two sites are in close proximity and have similar land uses, drainage area, hydrology, and other characteristics. Upstream of one paired site, however, controls will be installed, while the other site will not receive

additional controls. Automatic samplers and flow measurement devices are often used on both sites.

Watershed project managers should coordinate all monitoring with State-level monitoring programs, both to ensure compatibility of methods and to take advantage of state monitoring resources. While state agencies may not have sufficient resources to do intensive monitoring for every watershed project, monitoring stations and protocols may already be established under programs such as the following:

Fixed-station and rotating-station monitoring networks (e.g., under a statewide watershed approach of the state water quality agency)

Intensive surveys developed under point source wasteload allocation or nonpoint source programs

Fish community sampling by the state fish and game agency.

Highlight 6

Monitoring in the Galena River Priority Watershed Project

The Wisconsin Department of Natural Resources (WDNR) has delineated 330 watersheds for its statewide nonpoint source program. Approximately one-fifth of the watersheds are targeted for priority watershed projects. Each of these projects includes evaluation monitoring to assess water quality improvement.

The Galena River Priority Watershed is a 154,800-acre watershed with largely agricultural land uses--row crops and beef and dairy farming. Early in the project, WDNR assumed that the level of landowner participation in BMP cost-sharing would be high and that measuring improvements in surface waters would not be a problem. Mainly biological data were collected at random sites throughout the watershed prior to installation of BMPs. The plan was to return to these same sites following BMP installation to collect data for comparison to pre-project data.

Unfortunately, the level of landowner participation was much lower than expected, and the original monitoring strategy was not successful. A paired-site monitoring approach was then adopted to ensure that the effects of BMP implementation were being measured and to account for meteorologic and hydrologic variability (Spooner et al., 1985). Paired monitoring sites were selected, one on a stream with installed BMPs and the other on a nearby stream without BMPs. The paired streams had similar landscape, flow, gradient, temperature and habitat features.

Monitoring included water chemistry, macroinvertebrates, habitat, and fish community sampling. In the paired sites, each type of data indicated at least slightly better conditions at the managed sites (downstream of BMPs) than at the unmanaged sites.

Source: Kroner et al., 1992

Decide to Take Action

The project team may never be able to gather enough data to satisfy all technical participants or to convince all stakeholders that a problem exists. At some point the team decides to proceed with the project based on best judgment, allowing flexibility for mid-

course corrections later on. Following are some clues that the time has come to move on to goal-setting and developing a watershed action plan:

Technical experts believe that all significant problems in the watershed are known--problems in physical/chemical water quality, biological communities, instream and riparian habitat, and other factors required to meet designated uses.

If these problems were solved, ecological integrity of aquatic systems in the watershed could be achieved.

The nature of these problems is understood well enough that environmental indicators can be chosen to track progress in cleaning them up.

Sources of the problems are known or can be readily determined.